ARCADIS Design & Consultancy for natural and built assets

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ENVIRONMENT

Subject:

2017 First Quarter Operation Maintenance and Monitoring Report, Operable Unit 2, Northrop Grumman Systems Corporation and Naval Weapons Industrial Reserve Plant (NWIRP) Sites, Bethpage, New York. (NYSDEC Site #s 1-30-003A and B)

Date:
May 31, 2017

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Our ref:
NY001496.0216.RPTI4
NY001496.0416.NAVI4

Dear Jason:

On behalf of Northrop Grumman Systems Corporation (Northrop Grumman), Arcadis is providing the NYSDEC with the 2017 First Quarter Operation Maintenance and Monitoring Report (Report). This Report was prepared to document the operation, maintenance, and monitoring (OM&M) activities conducted for the on-site portion of the Operable Unit 2 (OU2) groundwater remedy and the results of ongoing volatile organic compound (VOC) and inorganic monitoring in groundwater to meet the remedial objectives set forth in the March 2001 OU2 Record of Decision (ROD).

Table 1 summarizes OU2 remedial system performance operational data and water balance. Tables 2 and 3 provide the analytical results for remedial system water and vapor samples for this period. Tables 4A and 4B provide the air modeling inputs and outputs and resulting analyses, based on vapor samples collected from the Tower 96 and Tower 102 systems, respectively, for this period. Table 5 provides a summary of percent mass removal of TCE from first quarter 2016 through first quarter 2017. Table 6 provides the validated analytical results of groundwater monitoring for this period. Figures 1 through 4 show the Locations of Wells and Onsite Groundwater Remedy, Locations of Treatment Systems and Discharges, ONCT Groundwater Extraction and Treatment System Site Plan, and the ONCT Groundwater Extraction and Treatment System Schematic, respectively.

Please contact us if you have any questions or comments.

Sincerely,

Arcadis of New York, Inc.

David E. Stern
Senior Hydrogeologist

Christopher Engler, P.E. 069748
Engineer of Record

Copies:

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Joseph DeFranco – Nassau County Department of Health
Lora Fly – NAVFAC Midlant Environmental
David Brayack – TetraTech NUS, Inc.
Roger Smith – Glenn Springs Holdings, Inc.
Manfred Bohms – Steel Equities
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Table 1
Operational Summary for the On-Site Portion of the OU2 Groundwater Remedy, First Quarter 2017 [1]
Operable Unit 2, Northrop Grumman Systems Corporation,
Bethpage, New York

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	Quarterly Flow Rates (gpm)		Quarterly Flow Volumes (MG)			Quarterly VOC Concentrations (µg/L)		VOC Mass Removed (lbs) [7]		
	Design [2]	Average [3,4]	Design [2]	Actual [3,4]	% of Design	TCE [5]	TVOC [3,4]	Quarterly	Annual	Cumulative
Influent Groundwater										
Well 1 [11,12]	800	796	103.7	103.0	99%	702	750	646	644	44,257
Well 3R [11,12]	700	811	90.7	105.0	116%	498	550	472	471	89,612
Well 17 [11]	1,000	996	129.6	129.0	100%	116	150	158	157	52,623
Well 18 [11,12]	600	915	77.8	118.0	152%	46	64	62	62	6,234
Well 19 [11,12]	700	674	90.7	87.0	96%	139	160	114	117	8,090
Total [13]	**3,800**	**4,192**	**493**	**542**	**110%**	**--**	**--**	**1,452**	**1,451**	**200,816**
Effluent Groundwater [6]										
Calpine	100 - 400	149	--	19.4	--	--	--	--	--	--
OXY Biosparge [10]	2 - 42	0	--	0	--	--	--	--	--	--
West Recharge Basins	1,112 - 1,455	1,998	--	259.0	--	--	1.2	--	--	--
South Recharge Basins	2,231	2,037	289.1	264.0	91%	--	1.4	--	--	--
Total [14]	**--**	**4,184**	**--**	**542**	**--**					
Additional Flow to South Recharge Basins										
Storm Water Runoff Contributing to South Recharge Basins Flow Volume [14]	--	--	--	18.0	--	--	--	--	--	--
Total Flow Volume to South Recharge Basins [14,15]			**289**	**282**	**98%**					

Treatment Efficiencies [8]	
Tower 96 System:	99.8%
Tower 102 System:	>99.9%

Notes and abbreviations on last page.

Table 1
Operational Summary for the On-Site Portion of the OU2 Groundwater Remedy, First Quarter 2017[(1)]
Operable Unit 2, Northrop Grumman Systems Corporation,
Bethpage, New York

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Notes and Abbreviations:

(1) Quarterly reporting period: January 03, 2017 through April 03, 2017.
(2) "Design" flow rates were determined for the five remedial wells and for the South Recharge Basins based on computer modeling (ARCADIS G&M, Inc. 2003c, modified in April 2005). Flow rates for Calpine, OXY Biosparge and West Recharge Basins are typical flow rates and are provided for reader information. "Design" flow volumes represent the volume of water that should be pumped/discharged during the reporting period and is calculated by multiplying the design rate by the reporting period duration.
(3) "Average" flow rates for the remedial wells represent the average actual pumping rates when the pumps are operational and do not take into account the time that a well is not operational. During this quarterly reporting period, the remedial wells operated for the following percentage of the time: Well 1 (99.9%), Well 3R (99.9%), Well 17 (99.9%), Well 18 (99.5%), and Well 19 (99.5%). "Actual" volumes are determined via totalizing flow meters.
(4) "Average" flow rates for the system discharges represent the average flow rate during the entire reporting period and are determined by dividing the total flow during the reporting period by the reporting period duration. The Calpine and South Recharge Basins flow volumes are determined via totalizing flow meters. The West Recharge Basin flow is calculated by subtracting the cumulative flow to the other discharges from the total influent flow. Actual flow to the recharge basins is greater, as shown, because storm water combines with the plant effluent prior to discharge to the recharge basins.
(5) The TCE and TVOC concentrations for the remedial wells are from the quarterly sampling event performed during this reporting period on February 14, 2017 (Table 2).
(6) The TVOC concentration for the two sets of recharge basins are their respective average monthly SPDES concentration for the current quarter.
(7) TVOC mass removed for the reporting period is calculated by multiplying the TVOC concentration from the quarterly sampling event and the quantity of water pumped during the reporting period.
(8) There are four discharges for the effluent groundwater: South Recharge Basins, West Recharge Basins, Calpine and OXY Biosparge system. Treated water is continuously discharged to the south and west recharge basins, and is available "on-demand" to both the Calpine Power Plant (Calpine) for use as make-up water, and the biosparge remediation system operated by Occidental Chemical (OXY Biosparge).
(9) Treatment System Efficiencies are calculated by dividing the difference between the remedial well flow weighted influent and effluent TVOC concentrations by the remedial well flow weighted influent concentration.
(10) Occidental Chemical has not reported any water usage for the OXY Biosparge system since May 2016.
(11) The majority of downtime during First Quarter 2017 was due to wet well pump failure at Tower 96 and low compressed air pressure at Tower 102. The wet well pump and air compressor are to be serviced.
(12) On February 15, 2017 the pumping rates associated with four remedial wells were temporarily reduced to accommodate recharge basin rehabilitation work. The pumping rates were reduced at Well 1 (850 to 760 gpm), Well 3R (970 to 700 gpm), Well 18 (1000 to 800 gpm) and Well 19 (700 to 660 gpm). The wells continued to operate at reduced pumping rates through the end of First Quarter 2017.
(13) Total pumpage/recharge rates are accurate to ±15% due to limitations in metering. Flow meter calibration was completed on September 29, 2016.
(14) Storm Water Runoff Volume is calculated by multiplying the adjusted tributary area and NOAA precipitation data for the reporting periods. The adjusted tributary area is tributary area that is adjusted by the runoff coefficient to exclude the infiltration volume from the total rainfall volume. The tributary area, runoff coeficient, and adjusted tributary area are from Dvirka and Bartilucci Consulting Engineers' Storm Water Permit Evaluation Report (January, 28, 2010). The NOAA precipitation data are calculated as a sum of NOAA daily precipitation data for the reporting period. NOAA precipitation data are retrieved from Station GHCND:USW00054787 - FARMINGDALE REPUBLIC AIRPORT, NY US.
(15) Total Flow Volume to South Recharge Basins is estimated as a sum of flow volumes contributed from the Effluent Groundwater to South Recharge Basins and from Storm Water Runoff to South Recharge Basins.

--	not applicable	NOAA	National Oceanic and Atmospheric Administration
µg/L	micrograms per liter	SPDES	State Pollution Discharge Elimination System
gpm	gallons per minute	TCE	trichloroethene
lbs	pounds	TVOC	total volatile organic compounds
MG	million gallons	VOC	volatile organic compounds

Table 2
Concentrations of Constituents in Remedial Wells and
Treatment System Effluents, First Quarter 2017, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

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Constituents (units in µg/L)	Location ID: Sample ID: Sample Date:	WELL 1 WELL 1 2/22/2017	WELL 3R WELL 3R 2/14/2017	96 EFFLUENT T96 EFFLUENT 2/14/2017
Volatile Organic Compounds (VOCs)[1]				
1,1,1-Trichloroethane		**0.35 J**	**0.78 J**	< 1.0
1,1,2,2-Tetrachloroethane		< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane		< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		**0.73 J**	**1.4**	< 1.0
1,1-Dichloroethene		**2.7**	**4.9**	< 1.0
1,2-Dichloroethane		< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		**4.5**	< 1.0	< 1.0
2-Butanone (MEK)		< 10	< 10	< 10
2-Hexanone (MBK)		< 5.0	< 5.0	< 5.0
4-methyl-2-pentanone (MIK)		< 5.0	< 5.0	< 5.0
Acetone		< 10	< 10	< 10
Benzene		< 0.50	< 0.50	< 0.50
Bromodichloromethane		< 1.0	< 1.0	< 1.0
Bromoform		< 1.0	< 1.0	< 1.0
Bromomethane		< 2.0	< 2.0	< 2.0
Carbon Disulfide		< 2.0	< 2.0	< 2.0
Carbon Tetrachloride		< 1.0	< 1.0	< 1.0
Chlorobenzene		< 1.0	< 1.0	< 1.0
Chloroethane		< 1.0	< 1.0	< 1.0
Chloroform		**0.32 J**	< 1.0	< 1.0
Chloromethane		< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene		**4.8**	**4.3**	< 1.0
cis-1,3-Dichloropropene		< 1.0	< 1.0	< 1.0
Dibromochloromethane		< 1.0	< 1.0	< 1.0
Ethylbenzene		< 1.0	< 1.0	< 1.0
Methylene Chloride		< 2.0	< 2.0	< 2.0
Styrene		< 1.0	< 1.0	< 1.0
Tetrachloroethene		**28**	**31**	< 1.0
Toluene		< 1.0	< 1.0	< 1.0
trans-1,2-Dichloroethene		< 1.0	< 1.0	< 1.0
trans-1,3-Dichloropropene		< 1.0	< 1.0	< 1.0
Trichloroethylene		**702**	**498**	**1.2**
Trichlorotrifluoroethane (Freon 113)		**4.3 J**	**4.0 J**	< 5.0
Vinyl Chloride		< 1.0	**3.9**	< 1.0
Xylene-o		< 1.0	< 1.0	< 1.0
Xylene-m,p		< 1.0	< 1.0	< 1.0
Total VOCs[2]		750	550	1.2
1,4-Dioxane[1]		8.91	16.4	11.1

Notes and abbreviations on last page.

Table 2
Concentrations of Constituents in Remedial Wells and
Treatment System Effluents, First Quarter 2017, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

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Constituents (units in µg/L)	Location ID: Sample ID: Sample Date:	WELL 17 WELL 17 2/14/2017	WELL 18 WELL 18 2/14/2017	Well 18 REP-121516-SN-1 2/14/2017	WELL 19 WELL 19 2/14/2017	102 EFFLUENT T102 EFFLUENT 2/14/2017
Volatile Organic Compounds (VOCs)[1]						
1,1,1-Trichloroethane		**0.28 J**	**0.43 J**	**0.43 J**	**0.33 J**	< 1.0
1,1,2,2-Tetrachloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		**0.89 J**	**1.2**	**1.1**	**0.71 J**	< 1.0
1,1-Dichloroethene		**1.9**	< 1.0	**1.3**	**1.5**	< 1.0
1,2-Dichloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Butanone (MEK)		< 10	< 10	< 10	< 10	< 10
2-Hexanone (MBK)		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
4-methyl-2-pentanone (MIK)		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Acetone		< 10	< 10	< 10	< 10	< 10
Benzene		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bromodichloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Disulfide		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Tetrachloride		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform		**0.24 J**	< 1.0	< 1.0	**0.37 J**	< 1.0
Chloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene		**2.8**	**2.1**	**2.2**	**16**	< 1.0
cis-1,3-Dichloropropene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene		**23**	**13**	**12**	**6.6**	< 1.0
Toluene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,2-Dichloroethene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,3-Dichloropropene		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene		**116**	**46**	**45**	**139**	< 1.0
Trichlorotrifluoroethane (Freon 113)		**3.3 J**	**1.3 J**	**1.2 J**	< 5.0	< 5.0
Vinyl Chloride		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene-o		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene-m,p		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total VOCs[2]		150	64	63	160	0
1,4-Dioxane[1]		8.74	7.24	6.67	6.34	6.13 J

Notes and abbreviations on last page.

Table 2
Concentrations of Constituents in Remedial Wells and
Treatment System Effluents, First Quarter 2017, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

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Notes and Abbreviations:

(1) VOC samples analyzed using USEPA Method 8260C. 1,4-Dioxane samples analyzed using USEPA Method 522 SIM.
(2) Results for the program are validated at 20% frequency, per protocols specified in OU2 Groundwater Monitoring Plan (Arcadis 2016c).
(3) Total VOC results rounded to two significant figures.

1.4 Bold value indicates the constituent was detected at or above its reporting limit.
< 5.0 Compound is not detected above its laboratory quantification limit.
µg/L micrograms per liter
J Constituent value is estimated.
NYSDEC New York State Department of Conservation
OU2 Operable Unit 2
REP blind replicate sample
SIM selective ion monitoring
VOC volatile organic compounds

Table 3
Vapor Sample Analytical Results for Treatment Systems,
First Quarter 2017, Northrop Grumman Systems Corporation,
Operable Unit 2, Bethpage, New York

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Location ID: / Sample ID: / Constituents (Units in µg/m³) / Date:	96 INFLUENT T96 INFLUENT 2/14/2017	96 SUP MIDTRAIN T96 SUP MIDTRAIN 2/14/2017	96 EFFLUENT T96 EFFLUENT 2/14/2017	102 INFLUENT T102 INFLUENT 2/14/2017	102 EFFLUENT T102 EFFLUENT 2/14/2017
Volatile Organic Compounds (VOCs)[1]					
1,1,1-Trichloroethane	**20**	< 0.55	< 0.55	**41**	< 0.55
1,1,2,2-Tetrachloroethane	< 0.69	< 0.69	< 0.69	< 0.69	< 0.69
1,1,2-Trichloroethane	**2.3**	< 0.55	< 0.55	**2.1**	< 0.55
1,1-Dichloroethane	**40**	< 0.81	< 0.81	**88.2**	**3.6**
1,1-Dichloroethylene	**132**	**1.4**	**1.1**	**222**	**19**
1,2-Dichloroethane	**2.2**	< 0.81	< 0.81	**6.1**	< 0.81
1,2-Dichloropropane	**78.1**	< 0.92	< 0.92	**6**	< 0.92
Benzene	**1.4**	< 0.64	< 0.64	**1.3**	**3.8**
Bromodichloromethane	< 0.67	< 0.67	< 0.67	< 0.67	< 0.67
Bromoform	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41
Bromomethane	< 0.78	< 0.78	< 0.78	< 0.78	**0.43 J**
Carbon disulfide	< 0.62	< 0.62	< 0.62	< 0.62	**16**
Carbon tetrachloride	**4.1**	< 0.25	< 0.25	**6.9**	< 0.25
Chlorobenzene	**1.9**	< 0.92	< 0.92	< 0.92	< 0.92
Chloroethane	**3.4**	**5**	**5.5**	< 0.53	< 0.53
Chloroform	**9.8**	< 0.98	< 0.98	**28**	**0.73 J**
Chloromethane	**0.91**	**1.2**	**3.3**	**0.95**	**1.0**
cis-1,3-Dichloropropene	< 0.91	< 0.91	< 0.91	< 0.91	< 0.91
Dibromochloromethane	< 0.85	< 0.85	< 0.85	< 0.85	< 0.85
Ethylbenzene	< 0.87	< 0.87	< 0.87	**0.74 J**	**2.2**
Methylene chloride	**1.3**	**3.2**	**2.3**	**1.1**	**1.3**
Styrene	< 0.85	< 0.85	< 0.85	< 0.85	< 0.85
Tetrachloroethylene	**1,110**	**1.2**	**2.9**	**698**	**3.9**
Toluene	**0.72 J**	< 0.75	< 0.75	**2.7**	**0.72 J**
trans-1,3-Dichloropropene	< 0.91	< 0.91	< 0.91	< 0.91	< 0.91
Trichloroethylene	**24,300**	**142**	**42**	**7,150**	**20**
Trichlorotrifluoroethane (Freon 113)	**134**	**2.3**	**0.77**	**165**	**4.2**
Vinyl chloride	**60.6**	**86.1**	**16**	**0.43**	**0.46**
Xylene-o	< 0.87	< 0.87	< 0.87	**10**	< 0.87
Xylenes - m,p	< 0.87	< 0.87	< 0.87	**6.1**	**4.0**
Total VOCs[2]	**25,903**	**242**	**74**	**8,437**	**81**

Notes and abbreviations on last page.

Table 3
Vapor Sample Analytical Results for Treatment Systems,
First Quarter 2017, Northrop Grumman Systems Corporation,
Operable Unit 2, Bethpage, New York

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Notes and Abbreviations:

(1)	Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.
(2)	"Total VOCs" represents the sum of individual concentrations of compounds detected rounded to the nearest whole number.
19	Bold data indicates that the analyte was detected at or above its reporting limit.
ELAP	Environmental Laboratory Approval Program
J	Compound detected below its reporting limit; value is estimated.
NYSDOH	New York State Department of Health
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
$\mu g/m^3$	micrograms per cubic meter

Table 4A
Summary of AERMOD Air Quality Impact Analysis
Tower 96 Treatment System, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

Constituent	CAS#	T90 Effluent (ug/m^3)	Emission Rate[1]			Scaled Impact - Hourly[2] (ug/m^3)	Scaled Impact - Annual[2] (ug/m^3)	SGC[3] (ug/m^3)	AGC[4] (ug/m^3)	Modeled Impacts < SGC and AGC (Yes/No)
		2/14/2017	lb/yr	lb/hr	g/s					
1,1 - Dichloroethene	00075-35-4	**1.1**	0.18	2.07E-05	2.61E-06	3.86E-04	1.13E-05	NS	200	Yes
Tetrachloroethene	00127-18-4	**2.9**	0.48	5.46E-05	6.88E-06	1.02E-03	2.99E-05	300	4	Yes
Trichloroethene	00079-01-6	**42**	6.92	7.90E-04	9.96E-05	1.47E-02	4.33E-04	20	2.00E-01	Yes
Vinyl Chloride	00075-01-4	**16**	2.64	3.01E-04	3.79E-05	5.62E-03	1.65E-04	180000	1.1E-01	Yes
Chloroethane	00075-00-3	**5.5**	0.91	1.04E-04	1.30E-05	1.93E-03	5.67E-05	NS	10000	Yes
Chloromethane	00074-87-3	**3.3**	0.54	6.21E-05	7.82E-06	1.16E-03	3.40E-05	22000	90	Yes
Dichloromethane	00075-09-2	**2.3**	0.38	4.33E-05	5.45E-06	8.07E-04	2.37E-05	14000	60	Yes
Trichlorotrifluoroethane (Freon 113)	00076-13-1	**0.77**	0.13	1.45E-05	1.83E-06	2.70E-04	7.93E-06	960000	180000	Yes

Notes and abbreviations on last page.

Table 4A
Summary of AERMOD Air Quality Impact Analysis
Tower 96 Treatment System, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

Notes and Abbreviations:

(1) Emission rate calculated based on effluent concentration and a stack air flow rate of 4,990 cfm. The stack air flow rate (in acfm) is taken from the actual stack air flow rate on the day of sampling. Effluent temperature used in the model was 96°F from direct read in-line gauge.
Trichloroethene (lb/hr) = TCE [ug/m^3] x Air Flow Rate [ft^3/min] x (1 m^3/35 ft^3) x (60 min/hr) x (0.000001 g/1 ug) x (0.0022 lb/g)
lb/yr = lb/hr x 8,760 hrs/yr
g/s = lb/hr x 1 hr/3,600 sec x 453.59 g/1 lb

(2) Ambient impact based on AERMOD modeling using noramalized rate of 1 g/s is scaled to the actual emission rate of the pollutant. Modeling was performed using the representative meteorological data from the nearest station (Farmingdale, NY) for the years 2011 through 2015, and a stack which is 55 feet high and 20 inches in diameter. The maximum impact from all the years was used for the calculations.
Scaled hourly impact (ug/m^3) = AERMOD predicted hourly ambient impact at 1 g/s ([ug/m^3]/[g/s]) x Actual emission rate (g/s)
Scaled annual impact (ug/m^3) = AERMOD predicted annual ambient impact at 1 g/s ([ug/m^3]/[g/s]) x Actual emission rate (g/s)

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([ug/m^3]/[g/s])	Annual ([ug/m^3]/[g/s])
148.05	4.35

(3) Short-term and annual guideline concentrations for air toxic pollutants specified in the NYSDEC DAR-1 AGC/SGC tables revised August 10, 2016.
(4) The receptor height corresponds to the average inhalation level.

µg/m^3	micrograms per cubic meter
lb/yr	pounds per year
lb/hr	pounds per hour
g/s	grams per second
26	bold value indicates a detection
AGC	annual guideline concentration
SGC	short-term guideline concentration
acfm	actual cubic feet per minute
CAS #	Chemical Abstracts Service Registry Number
DAR-1	Division of Air Resources-1
NS	none specified
NYSDEC	New York State Department of Environmental Conservation

Table 4B
Summary of AERMOD Air Quality Impact Analysis
Tower 102 Treatment System, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

Constituent	CAS#	T102 Effluent (ug/m^3)	Emission Rate[1]			Scaled Impact Hourly[2] (ug/m^3)	Scaled Impact Annual[2] (ug/m^3)	SGC[3] (ug/m^3)	AGC[3] (ug/m^3)	Modeled Impacts < SGC and AGC (Yes/No)
		2/14/2017	lb/yr	lb/hr	g/s					
1,1 - Dichloroethane	00075-34-3	**3.6**	0.96	1.09E-04	1.38E-05	4.80E-03	3.15E-05	NS	6.30E-01	Yes
1,1 - Dichloroethene	00075-35-4	**19**	5.05	5.77E-04	7.27E-05	2.54E-02	1.66E-04	NS	200	Yes
Tetrachloroethene	00127-18-4	**3.9**	1.04	1.18E-04	1.49E-05	5.20E-03	3.41E-05	300	4	Yes
Trichloroethene	00079-01-6	**20**	5.32	6.07E-04	7.65E-05	0.03	1.75E-04	20	2.00E-01	Yes
Vinyl Chloride	00075-01-4	**0.46**	0.12	1.40E-05	1.76E-06	6.14E-04	4.02E-06	180000	1.1E-01	Yes
Benzene	00071-43-2	**3.8**	1.01	1.15E-04	1.45E-05	5.07E-03	3.32E-05	1300	1.30E-01	Yes
Toluene	00108-88-3	**0.72**	0.19	2.19E-05	2.75E-06	9.61E-04	6.29E-06	37000	5000	Yes
Xylenes - M,P	01330-20-7	**4.0**	1.06	1.21E-04	1.53E-05	5.34E-03	3.50E-05	22000	100	Yes
Bromomethane	00074-83-9	**0.43**	0.11	1.31E-05	1.64E-06	5.74E-04	3.76E-06	3900	5	Yes
Carbon Disulfide	00075-15-0	**16**	4.26	4.86E-04	6.12E-05	2.14E-02	1.40E-04	6200	700	Yes
Chloroform	00067-66-3	**0.73**	0.19	2.22E-05	2.79E-06	9.74E-04	6.38E-06	150	14.7	Yes
Chloromethane	00074-87-3	**1.0**	0.27	3.04E-05	3.83E-06	1.33E-03	8.74E-06	22000	90	Yes
Dichloromethane	00075-09-2	**1.3**	0.35	3.95E-05	4.97E-06	1.73E-03	1.14E-05	14000	60	Yes
Ethylbenzene	00100-41-4	**2.2**	0.59	6.68E-05	8.42E-06	2.94E-03	1.92E-05	--	1000	Yes
Trichlorotrifluoroethane (Freon 113)	00076-13-1	**4.2**	1.12	1.28E-04	1.61E-05	5.60E-03	3.67E-05	960000	180000	Yes

Notes and abbreviations on last page.

Table 4B
Summary of AERMOD Air Quality Impact Analysis
Tower 102 Treatment System, Operable Unit 2,
Northrop Grumman Systems Corporation,
Bethpage, New York

Notes and Abbreviations:

(1) Emission rate calculated based on effluent concentration and a stack air flow rate of 8,050 cfm. The stack air flow rate (in acfm) is taken from the actual stack air flow rate on the day of sampling. Effluent temperature used in the model was 71°F from direct read in-line gauge.
Trichloroethene (lb/hr) = TCE [ug/m^3] x Air Flow Rate [ft^3/min] x (1 m^3/35 ft^3) x (60 min/hr) x (0.000001 g/1 ug) x (0.0022 lb/g)
lb/yr = lb/hr x 8,760 hrs/yr
g/s = lb/hr x 1 hr/3,600 sec x 453.59 g/1 lb

(2) Ambient impact based on AERMOD modeling using noramalized rate of 1 g/s is scaled to the actual emission rate of the pollutant. Modeling was performed using the representative meteorological data from the nearest station (Farmingdale, NY) for the years 2011 through 2015, and a stack which is 69.52 feet high and 24 inches in diameter. The maximum impact from all the years was used for the calculations.
Scaled hourly impact (ug/m^3) = AERMOD predicted hourly ambient impact at 1 g/s ([ug/m^3]/[g/s]) x Actual emission rate (g/s)
Scaled annual impact (ug/m^3) = AERMOD predicted annual ambient impact at 1 g/s ([ug/m^3]/[g/s]) x Actual emission rate (g/s)

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([ug/m^3]/[g/s])	Annual ([ug/m^3]/[g/s])
348.85	2.29

(3) Short-term and annual guideline concentrations for air toxic pollutants specified in the NYSDEC DAR-1 AGC/SGC tables revised August 10, 2016.
(4) The receptor height corresponds to the average inhalation level.

µg/m^3	micrograms per cubic meter
lb/yr	pounds per year
lb/hr	pounds per hour
g/s	grams per second
0.60	bold value indicates a detection
AGC	annual guideline concentration
SGC	short-term guideline concentration
acfm	actual cubic feet per minute
CAS #	Chemical Abstracts Service Registry Number
DAR-1	Division of Air Resources-1
NS	none specified
NYSDEC	New York State Department of Environmental Conservation

Table 5
Summary of TCE Mass Removal, Tower 96 Treatment System,
First Quarter 2017, Northrop Grumman Systems Corporation,
Operable Unit 2, Bethpage, New York[1,2,3]

Date	TCE Concentration (µg/m³)				TCE Mass Emission[4] (lbs)	Percent of Allowable TCE Emissions[5]		Percent Mass Removal		
	T96 INFLUENT	T96 MIDTRAIN	T96 SUP MIDTRAIN	T96 EFFLUENT		Period	Rolling	T96 MIDTRAIN	T96 SUP MIDTRAIN	T96 EFFLUENT
3/14/2016	24,892	4,311	NS	50	1.9	1.6%	3.3%	82.7%	NA	99.8%
5/12/2016	25,539	7,455	NS	49	1.2	1.5%	3.3%	70.8%	NA	99.8%
8/17/2016	24,787	4,232	NS	34	1.4	1.1%	2.1%	82.9%	NA	99.9%
12/22/2016	29,031	4,018	NS	161	8.4	4.8%	2.5%	86.2%	NA	99.4%
2/14/2017	24,300	NS	142	42	1.0	1.4%	2.6%	NA	99.4%	99.8%
3/21/2017	23,800	NS	2,580	1,280	20	42%	6.3%	NA	89.2%	94.6%

Notes and Abbreviations:

(1) Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.

(2) System transitioned from a regenerative VPGAC to once-through VPGAC system with PPZ polishing bed on 1/26/2017. Northrop Grumman is in process of pilot testing this operational modification as discussed with NYSDEC.

(3) PPZ media was removed from the polishing bed on 3/23/2017.

(4) TCE Mass Emission calculated based on the exhaust air flow rate on the day of sampling and the period of time since the preceding day of sampling.
TCE (lb) = TCE Concentration [µg/m^3] x Days x Flow Rate [ft^3/min] x (1 m^3/35 ft^3) x (60 min/hr) x (24 hr/day) x (0.000001 g/1 ug) x (0.0022 lb/g)

(5) Percent of allowable TCE emissions to date is a time-weighted annual rolling average based on the 500 lb/year emission limit specified in the CRR-NY 212-2.2 Table 2. High Toxicity Air Contaminant List, revised April 1, 2017.

italics dates of pilot test using once through carbon treatment operation.
µg/m^3 micrograms per cubic meter
lbs pounds
CRR-NY Codes, Rules and Regulations of the State of New York
ELAP Environmental Laboratory Approval Program
NA not applicable
NS not sampled
NYSDOH New York State Department of Health
PPZ potassium permanganate coated zeolite
SUP supplemental
TCE trichloroethylene
USEPA United States Environmental Protection Agency
VOC volatile organic compound
VPGAC vapor phase granulated activated carbon

Table 6.
Concentrations of Volatile Organic Compounds
and 1,4-Dioxane in Monitoring Wells [1]
BPOW 2-1, BPOW 2-2 and BPOW 2-3, First Quarter 2017
Operable Unit 2 (Groundwater),
Bethpage, New York

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Well: Sample ID: CONSTITUENT Date: Units (ug/L)	BPOW 2-1 BPOW 2-1 2/21/2017	BPOW 2-2 BPOW 2-2 2/21/2017	BPOW 2-3 BPOW 2-3 2/22/2017
Volatile Organic Compounds (VOCs) [2][3]			
1,1,1-Trichloroethane	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	<0.50	<0.50	<0.50
1,1,2-trichloro-1,2,2-trifluroethane	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	<0.50	<0.50	<0.50
1,1-Dichloroethane	<0.50	<0.50	<0.50
1,1-Dichloroethene	<0.50	<0.50	<0.50
1,2-Dichloroethane	<0.50	<0.50	<0.50
1,2-Dichloropropane	<0.50	<0.50	<0.50
2-Butanone (MEK)	<5.0	<5.0	<5.0
2-Hexanone	<2.0	<2.0	<2.0
4-methyl-2-pentanone (MIK)	<2.0	<2.0	<2.0
Acetone	<5.0	<5.0	<5.0
Benzene	<0.50	<0.50	<0.50
Bromodichloromethane	<0.50	<0.50	<0.50
Bromoform	<0.50	<0.50	<0.50
Bromomethane	<0.50	<0.50	<0.50
Carbon Disulfide	<0.50	<0.50	<0.50
Carbon tetrachloride	<0.50	<0.50	<0.50
Chlorobenzene	<0.50	<0.50	<0.50
Chloroethane	<0.50	<0.50	<0.50
Chloroform	<0.50	<0.50	<0.50
Chloromethane	<0.50	<0.50	<0.50
cis-1,2-dichloroethene	<0.50	<0.50	<0.50
cis-1,3-dichloropropene	<0.50	<0.50	<0.50
Dibromochloromethane	<0.50	<0.50	<0.50
Ethylbenzene	<0.50	<0.50	<0.50
Methylene Chloride	<0.50	<0.50	<0.50
Styrene	<0.50	<0.50	<0.50
Tetrachloroethene	<0.50	<0.50	<0.50
Toluene	<0.50	<0.50	<0.50
trans-1,2-dichloroethene	<0.50	<0.50	<0.50
trans-1,3-dichloropropene	<0.50	<0.50	<0.50
Trichloroethylene	<0.50	<0.50	<0.50
Vinyl Chloride	<0.50	<0.50	<0.50
Xylene-o	<0.50	<0.50	<0.50
Xylenes - m,p	<0.50	<0.50	<0.50
Total VOCs [4]	0	0	0
1,4-Dioxane [2] [3]	**1.32**	**0.333**	**3.68**

See last page for Notes and Abbreviations.

Table 6.
Concentrations of Volatile Organic Compounds
and 1,4-Dioxane in Monitoring Wells [1]
BPOW 2-1, BPOW 2-2 and BPOW 2-3, First Quarter 2017
Operable Unit 2 (Groundwater),
Bethpage, New York

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Notes and Abbreviations:

(1)	These outpost wells have been recently repurposed for use as plume monitoring wells per the June 2015 Groundwater Monitoring Plan Addendum (ARCADIS of New York, Inc., 2015) as conditionally approved by the NYSDEC (August 25, 2015). Therefore, TVOC trigger levels that may have been previously established are no longer shown
(2)	Samples were analyzed for VOCs using USEPA Method 524.2; samples were analyzed for 1,4-Dioxane using USEPA Method 522
(3)	Results for the program are validated at 20% frequency, per protocols specified in OU2 Groundwater Monitoring Plan (Arcadis 2016)
(4)	Total VOCs are rounded to two significant figures
0.333	Bold value indicates constituent detected at or above its reporting limit
TVOCs	Total Volatile Organic Compounds
VOC	Volatile Organic Compounds
µg/L	micrograms per liter
<0.5	Compound not detected above its laboratory quantification limit.

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\NY001496\1414\GWMI4\149614141414F01.dwg LAYOUT: 1 SAVED: 3/31/2016 10:05 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 3/31/2016 2:50 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
Xr1496X01
Xr3DR-CP

HWD 10208
HWD 8779
FORMER RUCO POLYMER SITE
(107)
HAYPATH ROAD
FARMERS AVENUE
(PLAINVIEW ROAD)
BWD 8768
BWD 8767
BWD 9591
BETHPAGE COMMUNITY PARK
BETHPAGE HIGH SCHOOL
NWIRP SITE (FORMER NAVY SITE)
PLANT 3
HN-24I
HN-24S
FW-03
HN-42S
HN-42I
HN-40S
HN-40I
GM-13D
GM-16I
GM-16SR
MW-3-1
WELL 3R
WELL 3
10597
GM-17SR
GM-17I
GM-17D
PLANT 5 BASINS
OU2 MAIN FACILITY REMEDIAL SYSTEM (TOWER 96)
OU2 MAIN FACILITY REMEDIAL SYSTEM (TOWER 102)
EXISTING OU2 TREATMENT SYSTEMS
MW-1GF
GM-32S
PLANT 2
PLANT 1 FUEL DEPOT AREA
GRUMMAN ROAD
BROADWAY
OU-2 ON-SITE GROUNDWATER REMEDY TREATMENT SYSTEMS
WELL 1
GM-39DA
GM-39DB
MW-2GF
GM-18S
GM-18I
GM-18D
GM-33D2
10631
WELL-17
10600
GM-78S
GM-78I
GM-78D
GM-78D2
GM-19S
GM-19I
MW-5
MW-4
MW-6
GM-15SR
GM-15I
GM-15D
GM-15D2
GM-73D3
GM-73D2
GM-73D
GM-74I
GM-74D
GM-74D2
GM-74D3
WELL-18
SOUTH BASINS
WELL-19
GM-20I
GM-20D
GM-21D2
10633
CENTRAL AVENUE
GM-21S
GM-21I
GM-21D
9921
GM-75D2
10624
10627
10634
GM-79I
GM-79D
10628
GM-37D
GM-37D2
GM-71D2
GM-70D2
GM-35D2
GM-36D
GM-36D2
N-10821
BWD 6915
6916
BWD 8941
3876
GM-38D
GM-38D2
BWD 8004
BLOOMINGDALE ROAD
NORTH WANTAGH AVE.
HICKSVILLE ROAD
STEWART AVENUE
LONG ISLAND RAILROAD
BETHPAGE STATE PARKWAY
SEAFORD - OYSTER BAY EXPRESSWAY
(GARDINER'S AVENUE)
MALLARD ROAD
LOWLAND ROAD
TOH(LWD) 7076
GM-34D
GM-34D2
PIKE
BPOW 1-4
BPOW 1-5
BPOW 1-6
BPOW 1-3
BPOW 1-1
BPOW 1-2
SFWD 7377
SFWD 5148
SFWD 4043
BOUNDARY AVENUE
BPOW 4-2R
BPOW 4-1R
TOH(LWD) 5303
BPOW 2-2
BPOW 2-3
BPOW 2-1
SFWD 6150
BPOW 3-3
BPOW 3-4
BPOW 3-2
BPOW 3-1
NYAW 9338
NYAW 8480
HICKSVILLE

EXPLANATION

- PROPERTY BOUNDARY OF THE FORMER GRUMMAN AEROSPACE SITE
- PROPERTY BOUNDARY OF THE FORMER NAVY SITE
- PROPERTY BOUNDARY OF THE FORMER OXY/RUCO SITE
- LONG ISLAND RAILROAD
- DENOTES NORTHROP GRUMMAN OWNED PROPERTY (AS OF 2009)
- DENOTES NAVY OWNED PROPERTY (AS OF 2014)
- DENOTES FORMER NAVY OWNED PROPERTY
- RECHARGE BASIN
- 10592 OBSERVATION/MONITORING/OUTPOST WELL (1)
- 9591 PUBLIC SUPPLY WELL (2)
- WELL-17 NORTHROP GRUMMAN REMEDIAL WELL
- PART OF ON-SITE REMEDY
- NWIRP NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
- TOH (LWD) TOWN OF HEMPSTEAD LEVITOWN WATER DISTRICT
- HWD HICKSVILLE WATER DISTRICT
- SFWD SOUTH FARMINGDALE WATER DISTRICT
- BWD BETHPAGE WATER DISTRICT
- NYAW NEW YORK AMERICAN WATER

NOTE:

(1) THIS FIGURE DEPICTS OBSERVATION/MONITORING/OUTPOST WELLS INCLUDED IN THE OU-2 GROUNDWATER MONITORING PROGRAM.

(2) PUBLIC SUPPLY WELLS ARE NOT SAMPLED AS A PART OF THE OU2 GROUNDWATER MONITORING PROGRAM AND ARE ONLY FOR REFERENCE.

0 1000' 2000'
APPROXIMATE SCALE IN FEET

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 2

LOCATIONS OF WELLS AND ON-SITE GROUNDWATER REMEDY

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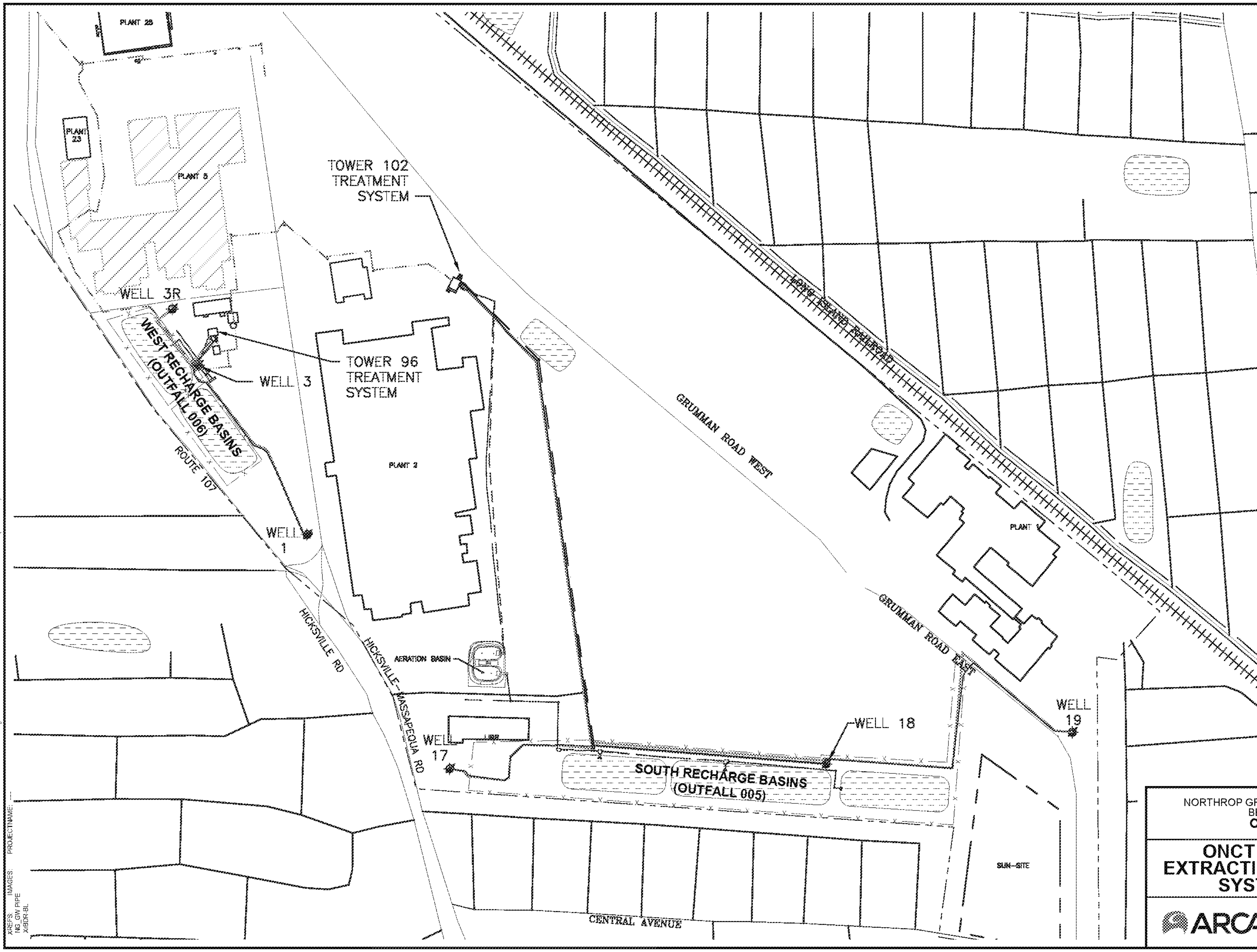
FIGURE 1



LEGEND:

- FORMER NORTHROP GRUMMAN PROPERTY LINE
- INFLUENT LINE
- BYPASS
- STORM DRAIN (EFFLUENT)
- NON POTABLE WATER DISTRIBUTION LINE (EFFLUENT)
- RAILROAD TRACKS
- FENCE
- WELL 18 — REMEDIAL WELL
- BASIN
- ONCT — ON-SITE CONTAMINANT

NOTES:

DRAWING IS NOT TO BE USED FOR DESIGN PURPOSES. LAYOUT OF PIPING IS FOR REPRESENTATION ONLY (LOCATIONS ARE APPROXIMATE).

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 2

ONCT GROUNDWATER EXTRACTION AND TREATMENT SYSTEM SITE PLAN

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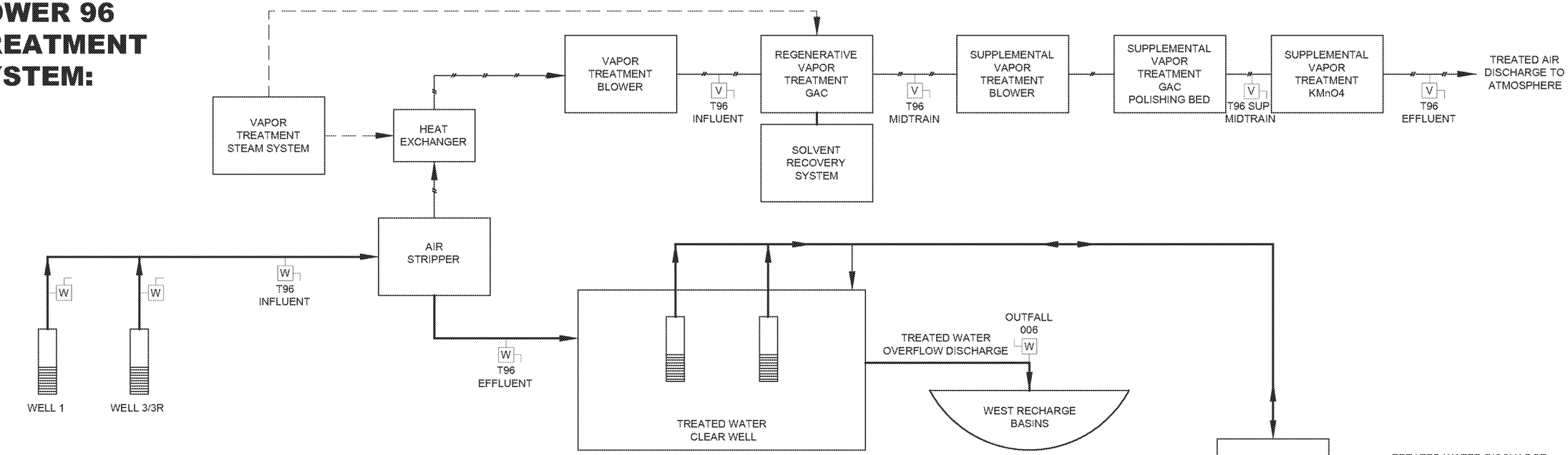
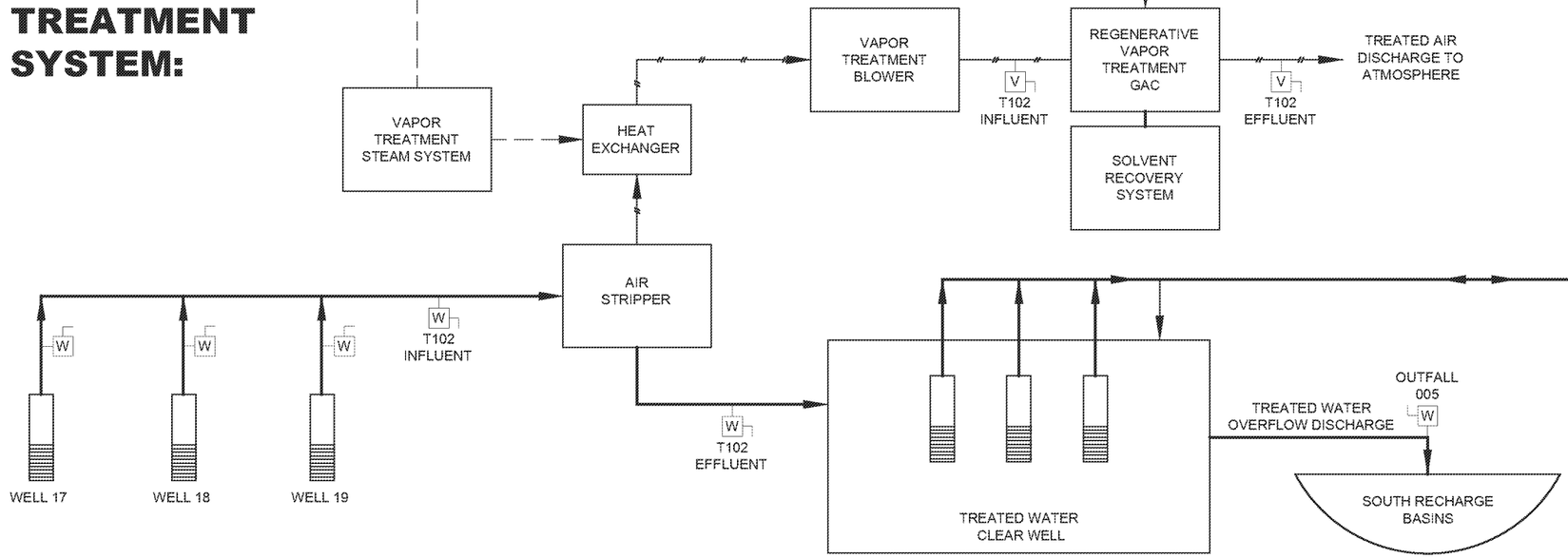
FIGURE
2

TOWER 96 TREATMENT SYSTEM:



TOWER 102 TREATMENT SYSTEM:



LEGEND:

- PROCESS WATER
- PROCESS AIR
- STEAM
- SAMPLE LOCATION
- W — WATER SAMPLE
- V — VAPOR SAMPLE
- ONCT — ON-SITE CONTAMINANT

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 2

ONCT GROUNDWATER EXTRACTION AND TREATMENT SYSTEM SCHEMATIC

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FIGURE 3